

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Appl. No. : **10/066,251** Confirmation No.: **9794**  
Inventor : **Richard L. Hammons et al.**  
Filed : **January 31, 2002**  
TC/A.U. : **2134**  
Examiner : **Andrew L. Nalven (571-272-3839)**  
Docket No. : **112-0020US**  
Customer No. : **29855**  
Title : **NETWORK SECURITY THROUGH CONFIGURATION SERVERS**

**PETITION TO WITHDRAW HOLDING OF ABANDONMENT**  
**AND DECLARATION IN SUPPORT**

This Petition is submitted by Applicant's Representative pursuant to 37 C.F.R. § 1.181. The undersigned hereby declares and petitions as follows:

1. A Notice of Abandonment was mailed in the referenced application on April 9, 2007. The Notice of Abandonment stated that the referenced application had gone abandoned for failure to file a timely reply to the Office Action of January 12, 2006.
2. A Response to the Office Action Mailed January 12, 2006 was filed on April 10, 2006, within the three-month shortened statutory period, using the Electronic Filing System. A copy of the Electronic Acknowledgment Receipt showing a Receipt Date of April 10, 2006 is attached. A complete copy of the Office Action, together with an Information Disclosure Statement that was filed therewith is also attached.
3. The Response to Office Action referenced above appears in the PAIR system showing a filing date of April 10, 2006.

4. Because a response was timely filed, the holding of abandonment is improper. Withdrawal of the holding of abandonment, reinstatement of the application, and an Office Action addressing the arguments filed is requested.
5. It is believed that no fee is due in connection with this petition. However, the Office is authorized to charge any fees or credit any overpayment to Deposit Account 501922 referencing attorney docket number 112-0020US.

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Appl. No. : **10/066,251** Confirmation No. **2791**  
Applicant : **Richard L. Hammons / Brocade Communications Systems, Inc.**  
Filed : **January 31, 2002**  
TC/A.U. : **2791**  
Examiner : **Andrew L. Nalven**  
Docket No. : **112-0020US**  
Customer No. : **29855**

Commissioner for Patents  
P. O. Box 1450  
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**RESPONSE TO OFFICE ACTION MAILED JANUARY 12, 2006**

Sir:

This paper is filed in response to the office action mailed on January 12, 2006. Because this response is sent within the three-month shortened statutory period, no fee is believed due. However, should any fees or refunds be due, this Office is authorized to deduct any such fees from or credit any such refunds to Deposit Account no. 501922 referencing attorney docket number 112-0020US.

Reconsideration of this application is respectfully requested.

**REMARKS**

Claims 1–29 and 54 are pending and were rejected. No claims are amended herein. Reconsideration and withdrawal of the rejections of each pending claim is requested in view of the following remarks.

**Introduction**

As an introductory matter, it appears from the office action that a brief tutorial on Fibre Channel networking would be beneficial for Examiner. Attached as an Exhibit to this response, and included in a contemporaneously filed Information Disclosure Statement, is a document entitled, “Fibre Channel Overview,” written by Zoltan Meggyesi. The Examiner is requested to review this document to gain a better understanding of the context of Applicants’ claimed invention.

**Rejections Under 35 U.S.C. § 112**

Claim 8 was rejected under 35 U.S.C. § 112 ¶ 2 as indefinite. Specifically, Examiner contends that the term “world wide name” is indefinite and relative. Applicant respectfully submits that “world wide name” is a term of art used in Fibre Channel networking. The term is defined in paragraph [0161] of Applicant’s specification as “unique numbers used to identify ports in certain networking systems such as in a Fibre Channel network.” The term is also discussed in various contexts at paragraphs [0075], [0088], [0093], [0101], [0120]–[0123], [0127], [0129], [0130]–[0131], [0133], [0162], [0164], and [0251]. From both the express definition and contextual discussion, one skilled in the art would clearly understand the term “world wide name” and would find it to be neither indefinite nor relative. Furthermore, discussion of the term “world wide name” occurs throughout the Fibre Channel standards submitted in the contemporaneously filed Information Disclosure Statement. Reconsideration and withdrawal of the rejection of claim 8 is therefore requested.

**Rejections Under 35 U.S.C. § 102**

Claims 1–9 and 11–15 were rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Pre-grant Publication 2002/0174207 by Battou (“Battou”). Of these claims, only claim 1 is independent, with the remaining claims depending either directly or indirectly therefrom. Because claim 1 includes limitations not disclosed by Battou, each of the dependent claims,

which necessarily incorporate the missing limitations are also allowable. Therefore, the following remarks address only independent claim 1. However, each dependent claim includes limitations neither disclosed nor suggested by Battou, and Applicant reserves the right to address these claims on their own merits at a latter time.

Independent claim 1 is drawn to a network configuration entity “configured or adapted to exclusively control a defined set of management functions throughout a secure network, … said set of management functions comprising the recognition, operation and succession of the network configuration entity.” In rejecting claim 1, Examiner has failed to address the limitation requiring that the network configuration entity maintain exclusive control over these functions. In fact, Battou teaches exactly the opposite, namely that a plurality of devices share control over recognition, operation and succession of the network configuration entity.

For example, at paragraph [0008] Battou describes “a hierarchical network management system in which a plurality of NMS managers, each responsible for different portions or aggregations of a communications network, are logically arranged in a tree structure.” The fact that there are multiple NMS managers, each responsible for different portions of the network completely negates the contention that any one of these devices maintains exclusive control over the required parameters. Battou goes on to explain that: “The NMS managers within each sub-group monitor the status of one another in order to detect when one of them is no longer operational. If this happens, the remaining operational NMS managers of the sub-group collectively elect one of them to assume the responsibility of the non-operational NMS manager.” Collectively deciding upon an order of succession for a failed network component is antithetical to claim 1, which requires that the network configuration entity maintain exclusive control over, among other things, “succession of the network configuration entity.”

Because the exclusive control limitation of claim 1 is neither taught nor suggested by Battou or the other art of record, reconsideration and withdrawal of the rejection of claim 1 and all claims depending therefrom is respectfully requested.

#### **Rejections Under 35 U.S.C. § 103(a)**

Claims 10, 16, 17–24, and 54 were rejected under 35 U.S.C. § 103(a) as obvious over Battou in view of various other references. Claims 10 and 16 depend from claim 1 and are therefore allowable for at least the reasons discussed above. Claims 17–29 and 54 include

various common limitations, and were addressed as one by Examiner. For clarity and convenience, Applicant respond in kind, but reserves the right to address the claims separately at a later time if necessary.

One element found in various of claims 17–24 and 54 that is not present in the combination of references proposed by the Examiner is: “a memory for storing an NCE list, said NCE list comprising an indication of each device in the network that may operate as said network configuration entity.” Examiner contends that this element is disclosed in Battou at Paragraphs [0268]–[0271]. While the Office Action does not identify a particular structure that is the memory for storing an NCE list, the undersigned presumes Examiner is referring to the “database server to store persistent data, e.g., longer-life data such as configuration and connection information.” However, this passage recites no teaching or suggestion that the configuration and connection information includes the required NCE list, namely, “an indication of each device in the network that may operate as said network configuration entity.” Rejection of the claims that include the NCE list limitation is therefore improper.

Another element found in various of claims 17–24 and 54 is the “DCC list, said DCC list comprising definitions that logically bind a port on the network configuration entity, to one or more other ports resident in the secure network.” Examiner contends that this element is taught in Battou at paragraphs [0307]–[0308]. However, the passages cited by Examiner appear to relate to routing a light path through various optical switching equipment. This is physical connection in an optical network, not logical binding as required by the DCC list limitation. The Examiner’s attention is directed to Applicant’s specification at paragraphs [0123]–[0128] for an explanation of the DCC list in context. Because the cited references fail to teach the required DCC list, rejection of claims 17–24 and 54 including this limitation is improper.

An additional element found in various claims among 17–24 and 54 is the “MAC list, said MAC list comprising an indication of network endpoints from which management access is acceptable.” Examiner concedes that the required MAC list is not present in Battou and proposes U.S. Pre-grant publication 2004/0015957 by Zara (“Zara”) to supply this missing limitation. While Zara does disclose “MAC” addresses, these are *media access control* addresses, which are unique identifiers of network adapters in an Ethernet network. The “MAC list” of the pending claims is a *management access control list*, and has nothing to do with

Ethernet MAC addresses. As can be seen from the plain language of the claim the MAC list must indicate the endpoints from which management is acceptable. The MAC address used for intrusion detection in Zara does not even bear passing resemblance to a list of devices from which management access is permitted. Therefore the rejection of claims 17–24 and 54 including this limitation is improper.

Additionally, each of claims 17–24 and 54 incorporate in some way, shape, or form, the exclusive control limitation discussed above with respect to claim 1. For example, claim 17 is drawn to a network configuration entity “configured or adapted to exclusively control a defined set of management functions....” Similarly, claim 18 is drawn to a Fibre Channel switching device ... wherein a defined set of management functions is controlled throughout said secure network by a network configuration entity....” Each of the remaining claims 19–24 and 54 include some variation of this limitation. However, as discussed above, Battou is drawn to a network in which the various functions enumerated in the claims are subject to distributed control among a plurality of NMS managers. Therefore, Battou fails to disclose the required exclusive control and is inappropriate for combination with other references because it teaches away from Applicant’s claimed invention. *See MPEP § 2143, et seq.*

#### **Claim 25**

The office action did not address claim 25. However, Applicant notes that claim 25 includes at least the requirement of network-wide, *i.e.*, exclusive, control over specified management parameters by a single network configuration entity, and is therefore patentable for at least the reasons outlined above with respect to claim 1.

\* \* \* \* \*

Applicant invites the Examiner to call the undersigned with respect to any questions pertaining to this application (832/446-2409).

Respectfully submitted,

April 10, 2006

Date

/Billy C. Allen III/

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# Fibre Channel Overview

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## 1 Introduction

In recent years several technical developments have converged to a bigger than ever need for extremely fast data links. High performance computers have become the focus of much attention in the data communications industry. Performance improvements have spawned increasingly data-intensive and high-speed networking applications, such as multimedia and scientific visualization. However, the existing network interconnects between computers and I/O devices are unable to run at the speeds needed.

The intention of the Fibre Channel (FC) is to develop practical, inexpensive, yet expendable means of quickly transferring data between workstations, mainframes, supercomputers, desktop computers, storage devices, displays and other peripherals. Fibre Channel is the general name of an integrated set of standards [1] being developed by the American National Standards Institute (ANSI).

There are two basic types of data communication between processors and between processors and peripherals: channels and networks. A channel provides a direct or switched point-to-point connection between the communicating devices. A channel is typically hardware-intensive and transports data at the high speed with low overhead. In contrast, a Network is an aggregation of distributed nodes (like workstations, file servers or peripherals) with its own protocol that supports interaction among these nodes. A network has relatively high overhead since it is software-intensive, and consequently slower

than a channel. Networks can handle a more extensive range of tasks than channels as they operate in an environment of unanticipated connections, while channels operate amongst only a few devices with predefined addresses. Fibre Channel attempts to combine the best of these two methods of communication into a new I/O interface that meets the needs of channel users and also network users.

Although it is called Fibre Channel, its architecture doesn't represent either a channel nor a real network topology. It allows for an active intelligent interconnection scheme, called a Fabric, to connect devices. All a Fibre channel port has to do is to manage a simple point-to-point connection between itself and the Fabric.

Fibre channel is a high performance serial link supporting its own, as well as higher level protocols such as the FDDI, SCSI, HIPPI and IPI (see chapter 7). The Fibre Channel standard addresses the need for very fast transfers of large amounts of information. The fast (up to 1 Gbit/s) technology can be converted for Local Area Network technology by adding a switch specified in the Fibre Channel standard, that handles multipoint addressing. There is a perspective as an I/O technology and a Local Area Network technology as well. Another advantage of Fibre Channel is, that it gives users one port that supports both channel and network interfaces, unburdening the computers from large number of I/O ports. FC provides control and complete error checking over the link [2] [3].

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## 2 Fibre Channel topology

In Fibre Channel terms the switch connecting the devices is called Fabric. The link is the two unidirectional fibres transmitting to opposite directions with their associated transmitter and receiver. Each fibre is attached to a transmitter of a port at one end and a receiver of another port at the other end. When a Fabric is present in the configuration, the fibre may attach to a node port (N\_Port) and to a port of the Fabric (F\_Port).

Since Fibre channel system relies on ports logging in with each other and the Fabric, it is irrelevant whether the Fabric is a circuit switch, an active hub or a loop. The topology can be selected depending on system performance requirements or packaging options. Possible FC topologies include point-to-point, crosspoint switched or arbitrated loop (Figure 1).

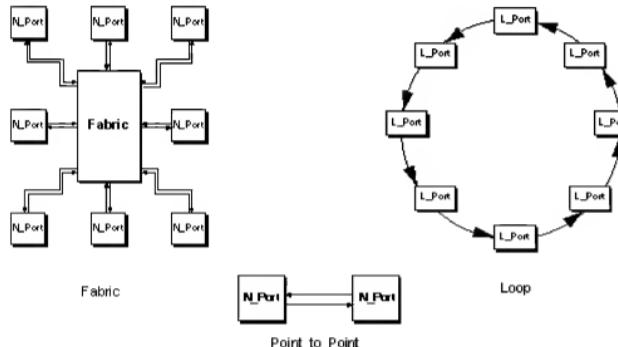


Figure 1 Fibre Channel topologies

FC operates at a wide variety of speeds (133 Mbit/s, 266 Mbit/s, 530 Mbit/s, and 1 Gbit/s) and on three types of both electrical and optical media. Transmission distances vary depending on the combination of speed and media. The single mode fibre optic media using longwave laser light source gives the highest performance (10 km maximum distance at 1 Gbit/s) [2].

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### 3 FC-0 layer

FC is structured as a set of hierarchical functions (Figure 2).

The lowest level (FC-0) defines the physical link in the system, including the fibre, connectors, optical and electrical parameters for a variety of data rates. Figure 3 shows the schematic of the Fibre Channel optical link [2].

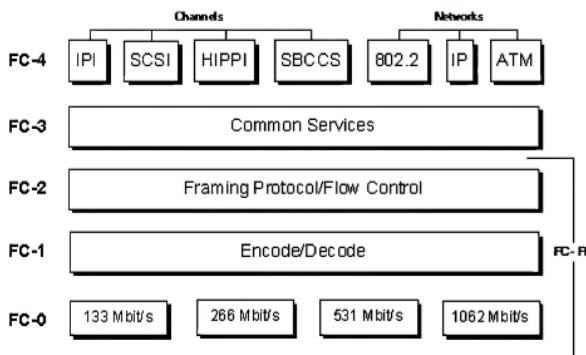


Figure 2 Fibre Channel structure

The system bit error rate (BER) at the supported media and speeds is less than  $10^{exp-12}$  [1]. The physical level is designed for the use of large number of technologies to meet the widest range of system requirements. An end-to-end communicating route may consist of different link technologies to achieve the maximal performance and price efficiency.

#### 3.1 Open Fibre Control

The FC-0 specifies a safety system - the Open Fibre Control system (OFC) - for SW laser data links, since the optical power levels exceed the limits defined by the laser safety standards. If an open fibre condition occurs in the link, the receiver of the Port the fibre is connected detects it and pulses its laser at a low duty cycle that meets the safety requirements. The receiver of the other port (at the other end of the fibre) detects this pulsing signal and also pulses its transmitter at a low duty cycle. When the open fibre path is restored both ports receive the pulsing signals, and after a double handshaking procedure the connection is automatically restored within a few seconds [1].

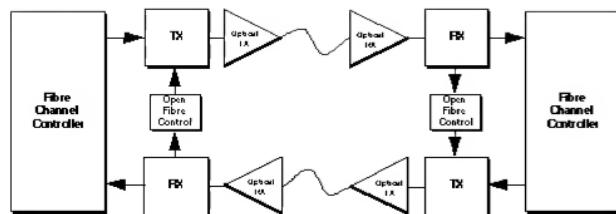


Figure 3 FC optical link

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## 4 FC-1 layer

FC-1 defines the transmission protocol including serial encoding and decoding rules, special characters and error control. The information transmitted over a fibre is encoded 8 bits at a time into a 10 bit Transmission Character. The primary rationale for use of a transmission code is to improve the transmission characteristic of information across a fibre. The transmission code must be DC balanced to support the electrical requirements of the receiving units. The Transmission Characters ensure, that short run lengths and enough transitions are present in the serial bit stream to make clock recovery possible [1] [2].

### 4.1 FC-1 character conversion

An unencoded information byte is composed of eight information bits A,B,C,D,E,F,G,H and the control variable Z. This information is encoded by FC-1 into the bits a,b,c,d,e,f,g,h,j of a 10-bit Transmission Character. The control variable has either the value D (D-type) for Data characters or the value K (K-type) for special characters. Each valid Transmission Character has been given a name using the following convention: Zxx.y, where Z is the control variable of the unencoded FC-1 information byte, xx is the decimal value of the binary number composed of the bits E, D, C, B, and A, and y is the decimal value of the binary number composed of the bits H,G of the unencoded FC-1 information byte in that order. For example the name of the FC-1 Transmission Character composed of the hexadecimal "BC" special (K-type) code is K28.5.

The information received is recovered 10 bits at a time and those Transmission Characters used for data (D-type) are decoded into the one of the 256 8-bit combinations. Some of the remaining Transmission Characters (K-type) referred to as special characters, are used for protocol management functions. Codes detected at the receiver that are not D- or K- type are signaled as code violation errors [1].

### 4.2 Coding rules

Each data byte or special character has two (not necessarily different) transmission codes. The data bytes and special characters are encoded into these codes respectively, depending on the initial Running Disparity (RD). The RD is a binary parameter, which is calculated upon the balance of ones and zeros in the sub-blocks (the first six bits and the last four bits) of a transmission character. A new RD is calculated from the transmitted character at both the transmitter and the receiver. If the detected character has opposite RD the transmitter should have sent, (depending on the RD of the previous bit

stream) the receiver indicates a disparity violation condition. A Transmission Word is composed of four contiguous transmission characters [1].

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## 5 FC-2 Layer

The Signaling Protocol (FC-2) level serves as the transport mechanism of Fibre Channel. The framing rules of the data to be transferred between ports, the different mechanisms for controlling the three service classes (see chapter 5.7) and the means of managing the sequence of a data transfer are defined by FC-2. To aid in the transport of data across the link, the following building blocks are defined by the standard [1] :

- Ordered Set
- Frame
- Sequence
- Exchange
- Protocol

### 5.1 Ordered Set

The Ordered Sets are four byte transmission words containing data and special characters which have a special meaning. Ordered Sets provide the availability to obtain bit and word synchronization, which also establishes word boundary alignment. An Ordered Set always begins with the special character K28.5. Three major types of Ordered Sets are defined by the signaling protocol.

The Frame delimiters (the Start-of-Frame (SOF) and End-of-Frame (EOF) Ordered Sets) are Ordered Sets which immediately precede or follow the contents of a Frame. There are multiple SOF and EOF delimiters defined for the Fabric and N\_Port Sequence control.

The two Primitive Signals: Idle and Receiver Ready (R\_RDY) are Ordered Sets designated by the standard to have a special meaning. An Idle is a Primitive Signal transmitted on the link to indicate an operational Port facility ready for Frame transmission and reception. The R\_RDY Primitive Signal indicates that the interface buffer is available for receiving further Frames.

A Primitive Sequence is an Ordered Set that is transmitted and repeated continuously to indicate specific conditions within a Port or conditions encountered by the receiver logic of a Port. When a Primitive Sequence is received and recognized, a corresponding Primitive Sequence or Idle is transmitted in response. Recognition of a Primitive Sequence requires consecutive detection of 3 instances of the same Ordered Set. The Primitive Sequences supported by the standard are Offline (OLS), Not Operational (NOS), Link Reset (LR) and Link Reset Response (LRR) [1] [2].

### 5.2 Frame

The basic building blocks of an FC connection are the Frames. The Frames contain the information to be transmitted (Payload), the address of the source and destination ports and link control information. Frames are broadly categorized as Data frames and Link\_control frames. Data frames may be used as Link\_Data frames and Device\_Data frames, link control frames are classified as Acknowledge (ACK) and Link\_Response (Busy and Reject) frames. The primary function of the Fabric is, to receive the

Frames from the source port and route them to the destination port. It is the FC-2 layer's responsibility to break the data to be transmitted into Frame size, and reassemble the Frames.

Each Frame begins and ends with a Frame Delimiter (Figure 4) The Frame Header immediately follows the SOF delimiter. The Frame Header is used to control link applications, control device protocol transfers, and detect missing or out of order Frames. An optional header may contain further link control information. A maximum 2112 byte long field (payload) contains the information to be transferred from a source N\_Port to a destination N\_Port. The 4 bytes Cyclic Redundancy Check (CRC) precedes the EOF delimiter. The CRC is used to detect transmission errors. [1] [2]

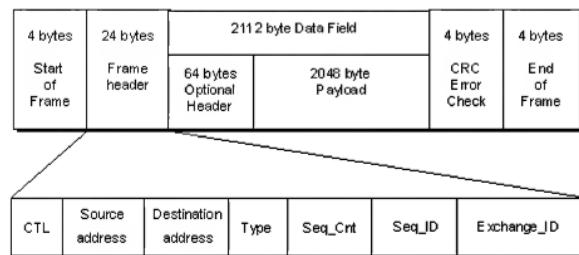


Figure 4 Frame Structure [2]

### 5.3 Sequence

A Sequence is formed by a set of one or more related Frames transmitted unidirectionally from one N\_Port to an other. Each Frame within a sequence is uniquely numbered with a Sequence Count. Error recovery, controlled by an upper protocol layer is usually performed at Sequence boundaries [2].

### 5.4 Exchange

An Exchange is composed of one or more nonconcurrent sequences for a single operation. The Exchanges may be unidirectional or bidirectional between two N\_Ports. Within a single Exchange, only one sequence may be active at any one time, but Sequences of different Exchanges may be concurrently active.

### 5.5 Protocol

The Protocols are related to the services offered by Fibre Channel. Protocols may be specific to higher-layer services, although Fibre Channel provides its own set of protocols to manage its operating environment for data transfer. The following Protocols are specified by the standard [1]:

- Primitive Sequence Protocols are based on Primitive Sequences (see chapter 5.1) and specified for link failure.
- Fabric Login protocol: The interchanging of Service Parameters of an N\_Port with the fabric.
- N\_Port Login protocol: Before performing data transfer, the N\_Port interchanges its Service Parameters with another N\_Port.
- Data transfer protocol describes the methods of transferring Upper Layer Protocol (ULP) data using the Flow control management of Fibre Channel (see chapter 5.6).

- N\_Port Logout Protocol is performed when an N\_Port requests removal of its Service Parameters from the other N\_Port. This may be used to free up resources at the connected N\_Port.

## 5.6 Flow control

Flow control is the FC-2 control process to pace the flow of Frames between N\_Ports and between an N\_Port and the Fabric to prevent overrun at the receiver. Flow control is dependent upon the service classes (see chapter 5.7). Class 1 Frames use end-to-end flow control, class 3 uses only buffer-to-buffer, class 2 Frames use both types of flow control.

Flow control is managed by the Sequence Initiator (source) and Sequence Recipient (destination) Ports using Credit and Credit\_CNT. Credit is the number of buffers allocated to a transmitting Port. The Credit\_CNT represents the number of data frames which have not been acknowledged by the Sequence Recipient.

The end-to-end flow control process paces the flow of Frames between N\_Ports. In this case the Sequence Recipient is responsible for acknowledging the received valid data Frames by ACK Frames. When the number of receive buffers are insufficient for the incoming Frame, a "Busy", when a Frame with error is received a "Reject" Frame will be sent to the Initiator Port. (see chapter 5.2) The Sequence Initiator is responsible for managing EE\_Credit\_CNT. The N\_Port login (see chapter 5.5) is used to establish EE\_Credit.

The buffer-to-buffer flow control is managed between an N\_Port and an F\_Port or between N\_Ports in point-to-point topology. Each port is responsible for managing BB\_Credit\_CNT. BB\_Credit is established during the Fabric Login (see chapter 5.5). The Sequence Recipient (destination) Port signals by sending a Receiver\_Ready primitive signal to the transmitting Port whether it has free receive buffers for the incoming Frames.

Figures 5-7 show the flow control management of the different service classes (see chapter 5.7) [1].

## 5.7 Service Classes

To ensure efficient transmission of different types of traffic, FC defines three classes of service. Users select service classes based on the characteristics of their applications, like packet length and transmission duration, and allocate the services by the Fabric Login protocol.

Class 1 is a service which provides dedicated connections, in effect providing the equivalent of a dedicated physical connection. Once established, a Class 1 connection is retained and guaranteed by the Fabric. This service guarantees the maximum bandwidth between two N\_Ports, so this is the best for sustained, high throughput transactions. In Class 1, Frames are delivered to the destination Port in the same order as they are transmitted. Figure 5 shows the flow control management of a Class 1 connection.

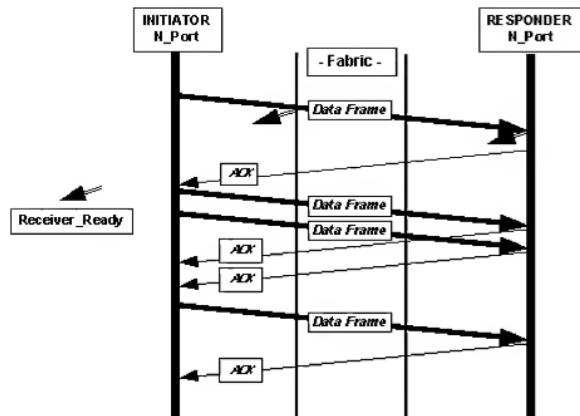


Figure 5 Class 1 Flow Control

Class 2 is a Frame-switched, connectionless service that allows bandwidth to be shared by multiplexing Frames from multiple sources onto the same channel or channels. The Fabric may not guarantee the order of the delivery and Frames may be delivered out of order. This service class can be used, when the connection setup time is greater than the latency of a short message. Both Class 1 and Class 2 send acknowledgment Frames confirming Frame delivery. If delivery cannot be made due to congestion, a Busy frame (see chapter 5.2) is returned and the sender tries again. (Figure 6)

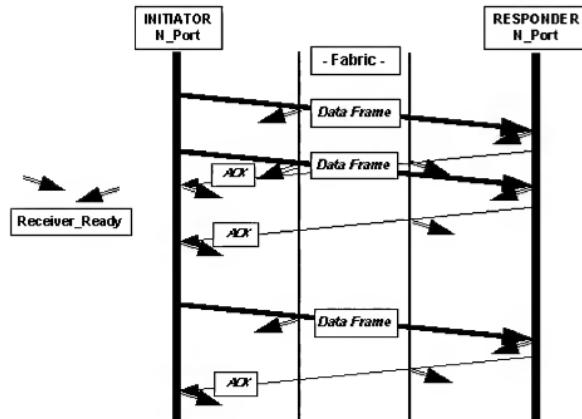


Figure 6 Class 2 Flow Control

Class 3 service is identical to Class 2, except that the Frame delivery is not confirmed. (Flow control is managed only on buffer level, see Figure 7) This type of transfer, known as datagram provides the quickest transmission by not sending confirmation. This service is useful for real-time broadcasts, where timeliness is key and information not received in time is valueless.

The FC standard also defines an optional service mode called intermix. Intermix is an option of Class 1 service, in which Class 1 Frames are guaranteed a special amount of bandwidth, but Class 2 and Class 3 Frames are multiplexed onto the channel, only when sufficient bandwidth is available to share the link [2] [3].

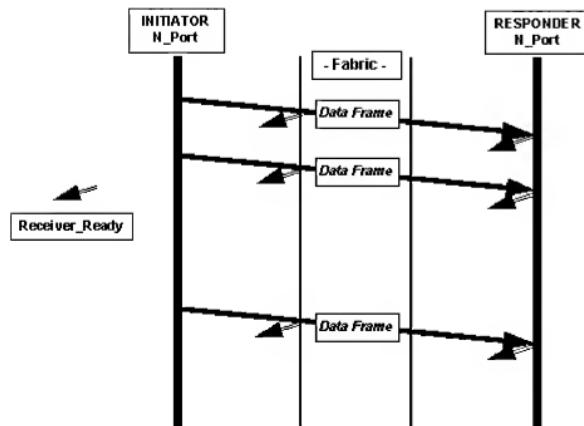


Figure 7 Class 3 Flow Control

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## 6 FC-3 Layer

The FC-3 level of the FC standard is intended to provide the common services required for advanced features such as:

- Striping - To multiply bandwidth using multiple N\_ports in parallel to transmit a single information unit across multiple links.
- Hunt groups - The ability for more than one Port to respond to the same alias address. This improves efficiency by decreasing the chance of reaching a busy N\_Port.
- Multicast - Multicast delivers a single transmission to multiple destination ports. This includes sending to all N\_Ports on a Fabric (broadcast) or to only a subset of the N\_Ports on a Fabric. [1]

## 7 FC-4 Layer

FC-4, the highest level in the FC structure defines the application interfaces that can execute over Fibre

Channel. It specifies the mapping rules of upper layer protocols using the FC levels below. Fibre Channel is equally adept at transporting both network and channel information and allows both protocol types to be concurrently transported over the same physical interface.

The following network and channel protocols are currently specified or proposed as FC-4s [2]:

- Small Computer System Interface (SCSI)
- Intelligent Peripheral Interface (IPI)
- High Performance Parallel Interface (HIPPI) Framing Protocol
- Internet Protocol (IP)
- ATM Adaptation Layer for computer data (AAL5)
- Link Encapsulation (FC-LE)
- Single Byte Command Code Set Mapping (SBCCS)
- IEEE 802.2

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## References

1. X3T9.3 Task Group of ANSI: Fibre Channel Physical and Signaling Interface (FC-PH), Rev. 4.2 October 8, 1993
2. Fibre Channel Association: Fibre Channel: Connection to the Future, 1994, ISBN 1-878707-19-1
3. Gary Kessler: Changing channels, LAN Magazine, December 1993, p69-78

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This is one of the CERN [High Speed Interconnect](#) pages - 15 August 1994 - [Erik van der Bij](#)

## Electronic Acknowledgement Receipt

EFS ID:	1020338
Application Number:	10066251
Confirmation Number:	2791
Title of Invention:	Network security through configuration servers in the fabric environment
First Named Inventor:	Richard L. Hammons
Customer Number:	29855
Filer:	Billy Collins Allen/Rebecca Ginn
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5	NPL Documents	FC-FG.pdf	2501800	no	17
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9	NPL Documents	FC-GS3.pdf	2106826	no	12
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13	NPL Documents	FC-SW2.pdf	3790202	no	39
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